ULTRASOUND TOUCHSCREEN USER INTERFACE AND DISPLAY

[0001] The present invention relates generally to medical diagnostic imaging systems, such as ultrasound imaging systems, and more particularly to a touchscreen user interface for such imaging systems.

[0002] Small, portable ultrasound imaging systems are available in the market today, including systems designated GE Logiq Book and Sonosite Titan. Mid-range ultrasound systems include the Philips Envisor. Both classes of ultrasound systems typically include a "hard" user interface (UI) consisting of physical keys in the form of a keyboard, buttons, slider potentiometers, knobs, switches, a trackball, etc. Most of these hard UI components are dedicated to specific control functions relating to use of the ultrasound system, and are labeled accordingly.

[0003] In addition, on some larger ultrasound systems, one or more electro-luminescent (EL) panel displays have been used to present a "soft" UI, typically consisting of variable, virtual keys on a touchscreen.

[0004] Both the hard and soft UI components are separate from the main display of the ultrasound system on which the generated ultrasound images are being displayed. The main display thus shows the ultrasound images and other textual or graphical information about the images, such as ECG trace, power level, etc., but does not allow direct user interaction, i.e., the user can only view the images being displayed but cannot interact with them via the main display. Rather, the user must turn to the hard UI components in order to change the parameters of the ultrasound images.

[0005] Some problems with existing ultrasound systems which comprise hard and soft UI components separate from the main display, e.g., a keyboard and an EL panel display, are added cost, complexity, power consumption, weight and maintenance of the separate components. It would therefore be desirable to incorporate both hard and soft UI components into the main display, thus eliminating the physical realizations of them and thereby avoiding the need to manufacture and maintain such separate UI components.

[0006] EP 1239396 describes a user interface for a medical imaging device with hard and soft components incorporated into a touchscreen display. The user interface includes a monitor on which an ultrasound image is displayed, a touchscreen in front of the monitor and activation areas and pop-up menus defined on the monitor screen. Each activation area is associated with a specific control function of the imaging system, e.g., mode select, penetration depth increase or decrease, zoom, brightness adjustment, contrast adjustment, etc., so that by touching the touchscreen over an activation area defined on the monitor screen, the associated function is performed.

[0007] US 2004/0138569 describes a graphical user interface for an ultrasound system in which a display screen has an image area and a separate control area on which control functions are defined, each in a separate area. The control functions are accessible via a touchscreen.

[0008] U.S. Pat. No. 6,575,908 describes an ultrasound system with a user interface which includes a hard UI component, i.e., a D-controller, and a touchscreen.

[0009] One problem with the prior art user interfaces is that they do not optimize the presentation of the activation areas. They also do not enable the manipulation of three-dimensional images.

[0010] It is an object of the present invention to provide a new and improved user interface for an ultrasound imaging system in which control functions are implemented as on-screen virtual devices.

[0011] It is another object of the present invention to provide a user interface for ultrasound imaging systems in which control functions are represented by activation areas on a touchscreen with an optimal presentation, namely, to facilitate the user's ability to easily select each activation area and/or to display activation areas simultaneous with ultrasound images while minimizing interference with the images and associated graphics.

[0012] In order to achieve these objects and others, a user interface for providing user control over device functions of an ultrasound imaging system in accordance with the invention includes a touchscreen on which ultrasound images are displayed and a plurality of activation areas selectively displayed on the touchscreen simultaneous with the display of ultrasound images. Each activation area has a unique assigned function relating to processing of the ultrasound images with an indication of the function being displayed on the activation area. A processor is coupled to the touchscreen for detecting a touch on the activation areas and performing the function associated with each activation area upon being touched. In this manner, all UI controls can be implemented as virtual controls by assigning the function of each control to an activation area so that the user can simply touch the activation area and effect the desired control. An assigned function can be a parameter relating to adjustment of the generation, processing or display of the ultrasound images, e.g., gain, compensation, depth, focus, zoom, or a display of additional activations areas, e.g., the display of pop-up menu which provide further available functions for selection.

[0013] One of the activation areas may be a segmented activation area including a plurality of activation areas arranged in a compact ring (or portion thereof) such that a center of each of these activation areas is equidistant from a common point, which might be the center of the segmented activation area. For example, in one embodiment, an activation area is defined on the touchscreen and when touched, causes the display of a pie menu of a plurality of additional activation areas. The pie menu is circular and each additional activation area has the form of a sector. The pie menu is centered at a location on the activation area touched by the user such that each of the additional activation areas is equidistant from the point of touch. This minimizes finger or stylus movement required by the user to select one of the additional activation areas. Instead of a circular pie menu, a polygonal menu can be displayed with each addition activational area having the shape of a trapezoid or triangle.

[0014] The function of each individual activation area can be to adjust a parameter in more than one direction, i.e., to increase or decrease gain, zoom, depth, etc., to thereby avoid the need to display two or more activation areas for a single parameter, e.g., one for gain increase and another for gain decrease. To obtain the adjustment of the parameter in the desired direction, the user sweeps across the activation area in the desired direction of the change in the form of a sliding touch, e.g., upward or downward, and the processor detects the sliding touch, determines its direction and then adjusts the